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MORE PRODUCTIVITY AT LOWER COST: **A QUARRY CHALLENGE**

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FINE SCREENING

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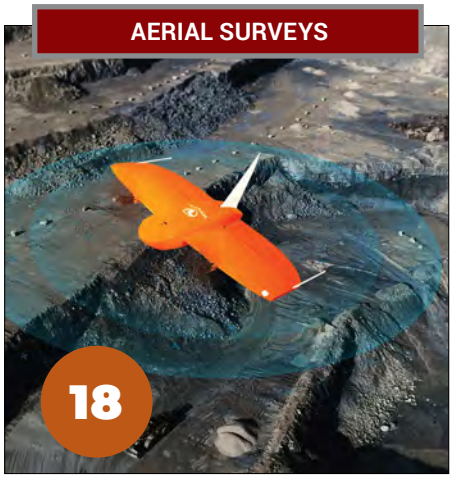

UNPACKING THE IMPACT OF COVID-19 ON SA'S CEMENT INDUSTRY

The impact of COVID-19 on the South African cement industry has been devastating, with Bheki Mthembu, head of the Inland Business Unit for Africa's largest cement producer, PPC, describing it as the 'final straw' for an industry already in survival mode prior to the pandemic.

HAUL ROADS – THE HEART OF EVERY QUARRY OPERATION

Haul roads maintenance requires a dedicated focus and must be addressed on a continual basis as part of the operational cycle since good roads improve production, extend tyre life and reduce overall operating costs.

AROUND THE INDUSTRY

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COMMENT

QUARRIES SHOULD PRIORITISE EFFICIENCY DURING TOUGH TIMES

The current business climate in the aggregates industry is characterised by price volatility, shrinking margins and increasing operational costs, among several other challenges that relate to legislative requirements. This is exacerbated by a steady decline in the growth of aggregates demand due to the lack of meaningful construction projects.

To provide context, South Africa's construction sector declined by 33,4% in Q2 2020 due to the COVID-19 pandemic. The country's recession worsened during the time GDP plunged by an annualised 51% in Q2 2020, which was worse than the central bank's 40,1% estimate. The contraction was broad based, hitting most sectors of the economy, with the construction sector the biggest loser, exacerbated by a very strict lockdown in April, followed by a gradual ease in May and June.

GlobalData forecasts South Africa's construction industry to contract by 14,3% in 2020. Although an improvement is expected during the second half of the year, as restrictions on activity are eased and construction sites and mines resume operations, the industry's outlook remains bleak and is expected to continue to be hit hard by the impact of high national debt, labour shortages and low infrastructure spending amid a depressed economy.

To survive and mine profitably during such a low growth cycle, quarry owners need to capitalise on the opportunity to improve their productivity and focus on one of the factors they can control: operational efficiency.

Increasing productivity is one of the ways quarry owners can counter diminishing profit margins as it effectively reduces operating costs. However, the emphasis should not only be on increasing output with the same input, but increasing the output while decreasing the input, and ultimately adding optimum value to current resources. Research shows that an increase in production will ultimately decrease the operation's unit cost, especially fixed costs.

One function that has a significant effect on unit costs in quarries is the drilling and blasting. Blasting is one of the most important operations, and has substantial technical and economic effects on any mining project. The prime aim of blasting is rock fragmentation that is necessary for subsequent processes – such as load and haul, crushing and screening – to achieve higher efficiency. Good blast design and execution are therefore essential for successful quarry operations. Improper or poor practices in blasting can have a severely ill impact on the economics of any operation.

Load and haul is probably the biggest cost driver for any quarry. Yet, if properly implemented, a load and haul optimisation programme can identify significant opportunities for operational improvement. The cost percentage of this process in the whole production equation is estimated to be between 25-30% based on the whole operation cost, including site personnel and vehicle costs.

So, how can quarry owners reduce their operation's unit cost related to load and haul? A reduction in the unit cost of loading and hauling can been achieved, on one hand, by applying new and innovative mining equipment and methods, and on the other hand, by optimising the use of existing equipment. To run a successful load and haul fleet optimisation programme, it is important to ensure that the machinery is correctly matched to the site and application, as well as the timing of cycles compared to the number of trucks.

While wet processing increases the value of aggregates, it is also a water-intensive process. Considerable water is lost to evaporation and incorporation into the product. Employing water efficiency practices reduces water loss and saves money. Recycling aggregate wash water can save large quantities of water. Most aggregate producers still use conventional settling ponds or tanks, but these have proved to be enemies of efficiency.

As you will see in this edition of *Modern Quarrying*, hydrocyclones have traditionally been preferred to meet fine separating cut requirements, while screen systems and other separation methods have generally been used for the size range above that. However, this convention now appears to have lost its validity, with dry technologies such as screens and air classifiers gaining the edge in finer size ranges. It is time quarries look at these technologies in their quest for better efficiencies.

Munesu Shoko – Editor

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Way forward for the recycled building material industry

Robust debate is needed in the construction industry to map a way forward for the recycling of demolition material on construction sites.

Surface mining industry association, ASPASA, says there is much talk about the recycling of building material, but little research of planning has been released to plot a way forward. Although recycling is a good idea in principal, complexities exist that will need to be resolved before industry-wide recycling will be viable.

ASPASA director, Nico Pienaar, says it will need close cooperation between all parties concerned to be successful. This must include the civil engineering fraternity that will be required to compile standards for recycled aggregates, quarries who have the equipment required to crush and screen material, as well as the demolition industry and recycling experts who will need to apply certain processes to prevent contamination of the material.

"Recycling of building material for any other purpose than backfill is a complex business. It requires complete separation of materials such as clay bricks, steel, glass, wood and other construction materials in order to guarantee the strength and durability of structures built with recycled constituents.

A rubble recycling site in South Africa.

"This kind of separation has its own challenges and will require specialised equipment that is able to deal with foreign objects such as metals, rubber and fines. Then there is the matter of identifying possible contaminates such as oils, chemicals, corrosives and others that may weaken concrete or lead to its degradation in years to come.

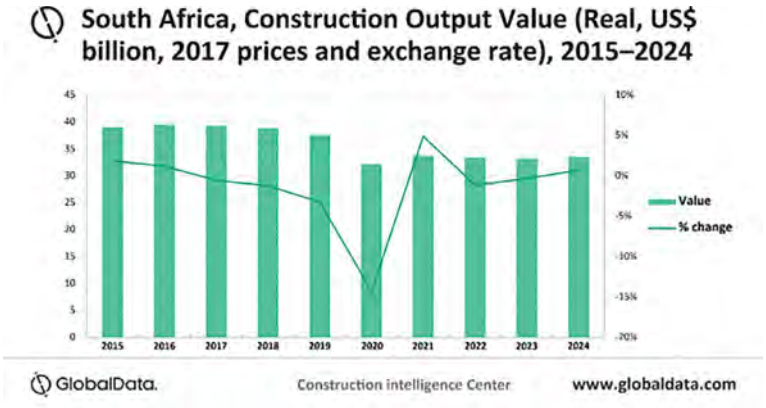
"Perhaps more significant is the correct grading of recycled materials that will change from load to load and construction site to construction site. It may even be necessary to have a new breed to specifiers who are qualified in the assessment of structures to be demolished and paths for the recycling and grading of it. And, these kinds of interventions will take time to plan and implement before the industry can move forward," says Pienaar.

He adds that successful projects are already in operation in other parts of the world where incentives exist and legislation requires the use of a certain percentage of recycled materials. In many instances these operations are run inside existing quarries where equipment and routes to market already exist."

South Africa's construction sector suffers worst quarterly slide

Following the release of construction output data for South Africa by Statistics South Africa, which revealed a sharp decline in output, Yasmine Ghozzi, economist at GlobalData, a leading data and analytics company, offers her view on the outlook for South Africa's construction sector.

"In line with GlobalData's expectations of a sharp decline in construction output in South Africa in Q2 2020 amid the COVID-19 pandemic, South Africa's construction industry is forecast to contract by 14,3% in 2020. Although there will be an improvement in the second half of the year, as restrictions on activity are eased and construction sites and mines resume operations, the industry's outlook remains bleak and is expected to continue to be hit hard by the impact of high national debt, labour shortages and low infrastructure spending amid a depressed economy.



South Africa's construction sector collapsed by 33,4% in Q2 2020.

"South Africa's construction sector collapsed by 33,4% in Q2 2020 – an outcome that was is in line with GlobalData's forecast of 33,1%. South Africa's recession has worsened as its GDP plunged by an annualised 51% in Q2 2020, which is worse than the central bank's 40,1% estimate. The contraction was broad based, hitting most sectors of the economy, with the construction sector the biggest loser, exacerbated by a very strict lockdown in April, followed by a gradual ease in May and June."

LafargeHolcim helps African customers go digital

From flexible orders to increased transparency via dashboards, LafargeHolcim's customers in Africa are growing their businesses with the help of Lead Retail, a mobile app from LafargeHolcim.

Mobile technology is expanding rapidly in Africa. Digital tools assist in overcoming limitations in physical infrastructure while reaching a growing middle-class that is expected to reach 900-million by 2040. Most African homeowners build and renovate their houses by themselves. Over two-thirds of cement in Africa is sold in bags, while in Europe and North America it is primarily sold in bulk.

Digital solutions can help African builders do more than just purchasing online and tracking their cement orders. "Our customers require transparent logistics, real-time balances and reliable cash management. Our mobile app 'Lead Retail' offers all these features – this explains how it continues to break sales records in Africa while helping retailers thrive."

"LH MAQER contributed to develop this app with a customer centric and bottom-up approach. Our digital team helps scale up innovative ideas and provides startups with an access to the global building materials sector."

Over 85 000 t of building materials have been sold through Lead Retail in Zambia. This online sales volume in the country has doubled between March and August 2020. For many retailers in Africa, transparency in logistics and cash management is crucial.

Empty shelves, lost or delayed orders, and simple fraud can be devastating for the businesses as well as the families and communities they support. "Thanks to Hima Cement and LafargeHolcim, my life has become digital. Nowadays I am able to see my orders, performance, payments and rebates any time, which gives me full confidence in the business," says Kimera Samuel Gyagenda from Masaka, Uganda.

"It was difficult to book and dispatch in the late hours and I couldn't follow up on my quantities on a daily basis. Now the app organises my daily life as it saves me time and effort," adds Ashraf Roshdy Elmorshdy from Kafr El-Sheikh, Egypt. "Today, I am more independent. Lead Retail gives me fewer intermediaries to place the order, speed, self-management of transactions, better visibility on rebates and zero paper," says Sawadogo Mamadou from Ferkessedougou, Ivory Coast.

New Code of Ethics for surface miners

Nico Pienaar, director of ASPASA.

Surface mining industry association, ASPASA, has transformed the nature in which the industry operates over the past two decades and plans to advance the industry still further with the mandatory introduction of a tough new Code of Ethics.

As a member of the global GAIN Network, which represents similar organisations across the globe, the association has already achieved much acclaim for its efforts in advancing health, safety and environmental compliance, as well as introducing a host of best practices for all aspects of operations.

The latest initiative pushes the goalposts of excellence in the industry still further as members opt-in to the new code which requires transparency and responsible management of all aspects of mining operations.

ASPASA director, Nico Pienaar, explains that the association has put measures in place to assist and ensure its members comply with legal and statutory requirements nationally, as well as within members' regions of operation. This ensures responsible mining practices are undertaken and that the welfare of people and the environment is a priority.

The new Code of Ethics now aims to make it easier to do business with an ASPASA member than ever before. Whether from a customer or other stakeholder perspective, the association aims to ensure its members' interactions are always professional, transparent and fair.

"The code simply documents good, ethical behaviour and while most member companies adhere to these anyway, it gives us recourse in the event of unethical behaviour being reported. It also promotes our members as customers can rest assured that the ASPASA member they are dealing with commits to ethical behaviour," says Pienaar.

Among the most significant conducts addressed by the new code for customers is the agreement not to mislead customers about the product, charge a fair price, to supply products timeously, to supply products in conformity with the South African National Standards SABS 1083 unless agreed otherwise, to provide a ready means for the customer to lodge complaints about the quality of the products and not to permit or condone any acts of unethical behaviour among others.

As far as obligations to suppliers is concerned, the code requires members to inform a supplier of any unethical behaviour by the supplier's personnel or any of the company's employees, the termination of dealings with any supplier displaying unethical behaviour, the meeting of obligations to suppliers or creditors within the time agreed and informing suppliers or creditors timeously of any inability to meet obligations and to take account of the interests of suppliers or creditors when requesting an extension of payment terms.

MB Crusher's BF90.3 attached to a Doosan DX225LC excavator.

MORE PRODUCTIVITY AT LOWER COST: A QUARRY CHALLENGE

Operational and economic efficiencies are essential for the management and stability of quarries and mines. Lower operating costs and fixed costs, as well as reduced maintenance and logistics costs are key factors in increasing productivity and speeding up processing times.

Crushing and reprocessing of the extracted product in quarries and mines has always been a very important work phase. It is often expensive, mainly because the material available is limited and destined to run out. Some have found a solution to these problems, by including MB Crusher units in their fleets.

MB Crusher's equipment gets attached directly to the heavy machines already present in the quarry and can work even in small or difficult to access spaces. Transporting an MB unit has no separate cost as it can travel to the site together with the excavator.

MB also gives a solution to this problem, since:

- the material can be crushed/screened on the spot, near where it was extracted; and
- the crushed/screened material can be reused in the quarry for the restoration/maintenance of the internal road network, without having to purchase the substrate material externally.

Quarrying activities are increasingly linked to safety, workers and manufacturing processes. From inside the excavator cabin, the operator puts the MB units into operation to recycle the material and manage the work safely.

Additionally, the maintenance of the MB units is also simple, fast and is done on-site, without risks.

High-quality material on the spot

Recycling spoil material must be done according to certain standards. This allows the processed material to be immediately reused.

Bucket crushers and bucket screeners from MB process any extracted materials, even the hardest and toughest ones. The design of the units provides output precision and regular shaped pieces, allowing material that was previously destined for the waste dump to be sold or reused on-site for the maintenance of the road network, filling of trenches and excavations, restoration of the quarry where necessary.

Crushing and recycling of clay and rocks

Used since ancient times in construction, clay is a versatile natural element, which also requires simple manufacturing processes. It is used for many applications,

A BF90.3 crusher bucket at a quarry site in Saudi Arabia.

KEY TAKEAWAYS

Crushing and reprocessing of the extracted product in quarries and mines has always been a very important work phase

MB Crusher's equipment gets attached directly to the heavy machines already operating at the quarry and can work even in areas where space is at a premium

Many fleet owners across the world are turning to MB Crusher units as a solution to economically recycle rubble material

A key advantage of the MB bucket crusher and screener solutions is that the material can be crushed/screened on the spot, close to where it was extracted

for example, to make lightweight concrete or kiln bricks. Due to its compressive strength, clay is also used for screed preparation, while in the form of bricks it is used in roofs, wall and floor tiles.

At a quarry in the Saudi kingdom, a BF90.3 excavator crusher was installed on a Doosan 225LCA digger to recycle rocks and clay, the product obtained was then reused by the same company for other operations inside the quarry.

Sieving and crushing of rocks and sand

Scan QR code to watch MB Crusher's BF90.3 excavator crusher in action at a Saudi quarry.

For this application, the perfect combination is to use two MB units – two of the largest models of the range.

At a recent job, an MB-S23 screener bucket, the largest in the world, was attached to a Caterpillar

Bucket crushers and bucket screeners from MB process any extracted materials, even the hardest and toughest ones.

The maintenance of the MB units is also simple, fast and is done on-site, without risks.

349D excavator to select the mixed sand and rocks. Rocks were then crushed by the BF135.8 jaw crusher.

Screening the material allows for the reduction of up to 60% of the crushing time. This type of operation ensures that the product is clean, of quality and ready to be reused.

Scan QR code to watch an MB unit in a sieving and rock and sand crushing application.

Rock crushing in steep places

Combining the work of a fixed crusher with the MB crusher is a solution that many quarry owners have already adopted because the mobile crusher can work in confined spaces. At a recent project, a BF90.3 crusher bucket was deployed to work with a Doosan excavator in a place where the fixed plant could not be transported. ●

Scan QR Code to watch an MB crusher crushing rock in steep places.

FROM ROCK TO ROAD

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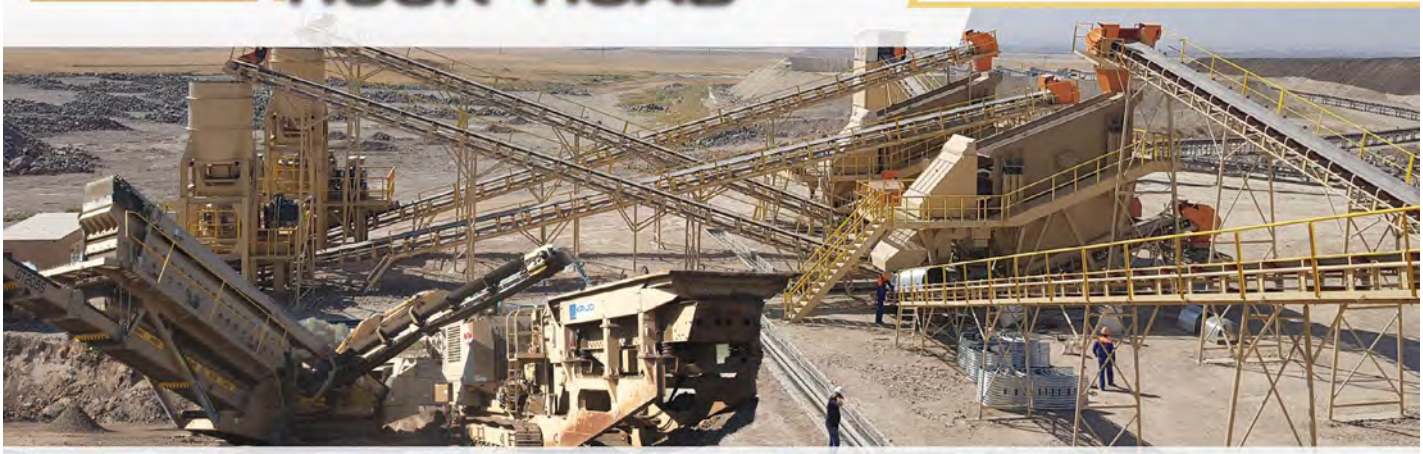

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Bheki Mthembu, head of the Inland Business Unit at PPC.

UNPACKING THE IMPACT OF COVID-19 ON SA'S CEMENT INDUSTRY

The impact of COVID-19 on the South African cement industry has been devastating, with Bheki Mthembu, head of the Inland Business Unit for Africa's largest cement producer, PPC, describing it as the 'final straw' for an industry already in survival mode prior to the pandemic. By Munesu Shoko.

That the cement industry in South Africa is in dire straits due to the COVID-19 pandemic is no overstatement. While almost all sectors of the economy have been hit hard, Bheki Mthembu acknowledges that the cement industry is one of the worst-hit during the current pandemic.

According to Mthembu, the industry was already in survival mode pre-COVID-19 and the outbreak of the pandemic pretty much served as the "final nail in the coffin". The business environment pre-COVID-19 was already tough, with the industry operating at almost half of its capacity, with the importation of cheap cement from Asia undercutting local manufacturers by at least 45% exacerbating the situation.

"Prior to COVID-19, the cement industry in South Africa was already at 'rock bottom', with most of the cement producers having to halve their capacities. We also had to fight against the importation of cheap, substandard cement into

PPC is the biggest cement producer in Africa.

the country, while calling to order the so-called cement blenders who were taking shortcuts as far as their quality and subsequent prices were concerned," explains Mthembu.

To provide some context, figures from The Concrete Institute show that South Africa has become a net importer of cement with total imports increasing by 139% since 2016. A total of 350 441 tonnes (t) of cement arrived in South Africa during the second quarter of 2019 – the most since the third quarter of 2015. Most of the cement landed at Durban at the time – the 260 909 t that arrived there was an 85% increase on the first quarter of 2019.

Combined with unprecedented low levels of demand due to slowed economic growth, the industry was already facing a survival crisis pre-COVID-19. The COVID-19 influenced hard lockdown, dubbed Alert level 5 of South Africa's tiered approach to fighting the pandemic, saw the complete shutdown of the cement sector and the construction industry at large, leaving cement producers with absolutely no revenue during the month of April.

KEY TAKEAWAYS

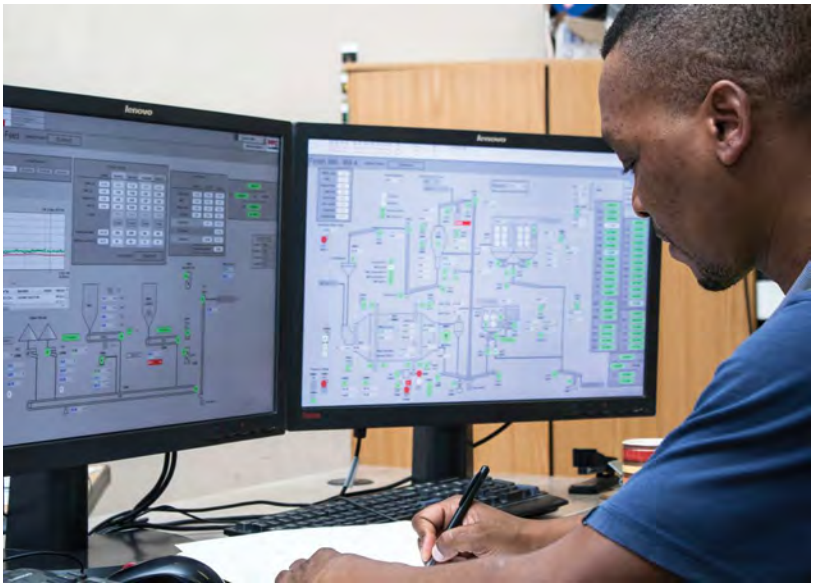
The cement industry in South Africa was already in survival mode pre-COVID-19 and the outbreak of the pandemic pretty much served as the 'final nail in the coffin'

The business environment pre-COVID-19 was already tough, with the industry operating at almost half of its capacity, while the importation of cheap cement from Asia undercutting local manufacturers by at least 45% exacerbated the situation

PPC has seen a notable recovery of the market due to some small-scale building and renovation activities currently underway

PPC believes that technology and innovation will play a central role in the future of the cement industry. In such a highly competitive environment, conventional business approaches will lose their place

PPC's Jupiter cement plant in Germiston, Gauteng, South Africa.



Digitalised and highly automated production in the cement sector is more important than ever to gain a competitive edge.

While Alert Level 4 regulations allowed the cement manufacturers to operate at 50% capacity levels, the construction industry was still completely shut, leaving cement manufacturers in a precarious position. The start of Alert Level 3 in June offered some reprieve for the industry, with Mthembu noting some recovery, notably driven by the retail sector.

Notable recovery

"We have seen a notable recovery of the market due to some small-scale building and renovation activities currently going on. Thus, the retail sector has been a bit positive for us in June and July. However, there is very little happening on the large construction projects front," says Mthembu.

One inherent advantage that PPC has over some of its competitors is the wider geographical footprint. To give an idea, under Alert Level 4 of the lockdown, government allowed cement operations to operate at 50% of their capacity. Thus, a cement producer with only two sites, for example, operating at 50% of its capacity, is nowhere near PPC's 50% capacity across eight factories around South Africa, says Mthembu.

PPC's extensive geographical footprint, he says, also means that the company can still operate sustainably in the event that one of the operations records a positive COVID-19 case, which according to government regulations, necessitates immediate closure for deep cleaning and disinfecting purposes. "We can, therefore, navigate the challenges posed by COVID-19," he says.

Lessons learnt

While COVID-19 has had a devastating impact on the economy, Mthembu believes it has also served as a wake-up call for the government, highlighting the need to prioritise infrastructure development as the path to economic recovery, as well as to fight social ills such as the lack of water sanitation and housing.

In an environment where people are obliged to social distance and continuously wash hands to curb the spread of the virus, Mthembu notes that the call is impossible in areas like townships where, for example, a family of seven has to share a two-bedroom house, and the provision of potable water is erratic. To this end, the government has been on record saying that there is need to drive housing and water infrastructure aggressively.

Apart from the need to prioritise social infrastructure, Mthembu believes that the government also understands that the quickest route to resuscitating the economy post-COVID-19 is via infrastructure development. "In June the government hosted the Sustainable Infrastructure Development Symposium, where President Cyril Ramaphosa made promising commitments to prioritise infrastructure development to support structural transformation, creation of jobs and economic recovery," he says.

The symposium notably reflected on a number of projects that have been identified by the National

Infrastructure Fund. The fund has finalised a list of projects worth ZAR700-billion (£30,8-billion) over the next 10 years.

Mthembu is of the view that as South Africa works towards overcoming the social and economic fallout of COVID-19, the development of key infrastructure will play a critical role in building the economy and creating jobs. Infrastructure development can be the catalyst that places the country on a new growth trajectory, he says.

"As the cement industry, we remain optimistic that if these strategic objectives of the government materialise, the construction sector will rebound, creating many jobs and contributing to a quick turn of the economy," he adds.

To the future

Looking ahead, Mthembu is of the view that the more pressing concern for cement manufacturers post-COVID-19 will be the increased pressure to rapidly ramp up production in an effort to recoup output lost during the lockdown.

Like many, Mthembu believes that technology and innovation will play a central role in the future of the cement industry. In such a highly competitive environment, conventional business approaches will lose their place, he reiterates.

Mthembu is a proponent of innovation and modernisation, key values shared by his company, PPC. PPC understands that modernisation of its plants is critical to building and sustaining the momentum needed for long-term development.

"Technology in future will play a central role in the cement industry. Robotics and instrumentation, for example, will take over the role of labour in manual operations where you have people loading and unloading cement bags, for example. In Africa you still find that this task is largely done manually, which, in the current operating conditions, makes it difficult for people to social distance due to the labour intensive nature of these functions," he reasons.

Mthembu believes that the current situation creates major challenges for cement companies, not only in South Africa, but across the continent, and shows that digitalised and highly automated production is more important than ever when it comes to gaining a competitive edge.

"This is the only way that companies can react to current and future challenges with the required degree of flexibility," he says, adding that just as important as the tools are the staff operating these new technologies. Automatic and digital processes, he says, will be made possible by a pool of well-trained and skilled people who understand the complexities of the technology.

Thus, the key benefit of the approach to modernisation, he says, is skills transfer, equipping current and future generations with critical skills related to advanced cement manufacturing technology, as well as technical sales and distribution.

From a productivity perspective, Mthembu says new technology helps cement manufacturers with the much needed efficiency and higher throughputs than older technology. "Technology plays a significant role in driving efficiency, allowing cement producers to run at a lower cost per tonne, which helps with the paying back of the capital investment quite faster."

Additionally, Mthembu believes that post COVID-19 cement producers must be more concerned about two main objectives – a smaller carbon footprint and less energy consumption, especially considering that a carbon tax introduced in 2019 on the South African cement industry's activities will definitely increase the industry's production costs.

Much of the cement industry's industrial production techniques needs a revamp. Cement production is one of the most polluting and energy intensive processes, and the demand for a better way is only equalled by the demand for the product itself. "New technology will be the best of both worlds for the industry; it will help the industry meet its sustainability goals, while reducing operating costs significantly through energy efficient plans," concludes Mthembu. ●

ON PHOTO: PILOT CRUSHTEC SCREEN
Screen technology is penetrating into ever finer size ranges.

THE ADVENT OF DRY SEPARATION IN FINE SCREENING

Hydrocyclones have traditionally been preferred to meet fine separating cut requirements, while screen systems and other separation methods have generally been used for the size range above that. However, this convention now appears to have lost its validity, with dry technologies such as screens and air classifiers gaining the edge in finer size ranges. By Munesu Shoko.

Diverse classification methods are used in quarrying and mining applications. Hydrocyclones have historically been the go-to solution for fine separating cut requirements. However, other technologies such as fine screen technology and air separators are challenging the status quo, and are penetrating into ever finer size ranges.

Jorge Abelho, director – Technical Support at Pilot Crushtec International, reasons that traditional mining makes use of wet processing technologies such as hydrocyclones to remove fines from products. With the global push to reduce the

KEY TAKEAWAYS

Hydrocyclones have historically been the preferred solution for fine separating cut requirements

Traditional mining makes use of wet processing technologies such as hydrocyclones to remove fines from products. With the global push to reduce the environmental impact, new and more efficient dry technology is gaining favour

In future, air separation will play a major role in fine screening – there is no need for water or any subsequent costly treatment of wastewater

Air classifiers separate and recover ultrafine, fine and coarse materials in mining, aggregates production, sand manufacturing and other industrial processes

Screening is one of the dry processes that can be used for fines separation.

environmental impact, he says, new and more efficient dry technology is gaining favour.

"Hydrocyclones make extensive use of water, which is already a scarce natural resource in most areas of the world. Then there are challenges and costs associated with the treatment of the contaminated water," says Abelho.

Wet processing, he says, is significantly more efficient in removing fines than screening. There are, however, improvements in fine screening, but there also are challenges associated

Any fines separation technology that does not make use of a scarce natural resource such as water is going to have an advantage over hydrocyclones.

Removal of the fines is necessary for the beneficiation of products.

with blinding of screens as well as the significantly larger screen areas required for similar production rates if compared to wet processing. As far as wet processing is concerned, governments are also reviewing or implementing regulations which further control the use and disposal of water in mining applications.

"I believe that in future, air separation will play a major role in fine screening. There is no need for water or any subsequent costly treatment of wastewater. There is less impact on the environment when using air separation and the material cut points can be easily adjusted," says Abelho.

Air separation to the fore

Generally, in quarrying and mining applications, says Abelho, fines are an undesired by-product from the blasting and crushing processes. Removal of the fines is necessary for the beneficiation of the products. Traditionally, fines were regarded as a waste product and ended up in tailings dams if removed by a wet process.

"Screening is one of the dry processes that can be used for fines separation, but I see more development and potential in the air separation technology in the future," he says.

Any fines separation technology that does not make use of a scarce natural resource such as water is going to have an advantage over hydrocyclones, he adds. "Access to water, tightening regulations, the 'green movement', as well as the costs associated with treating or disposing of contaminated water are all driving the initiative for dry separation methods. There is also no need for tailings or settling dams where screens or air classifiers are used," says Abelho.

Fine screening, he says, does have its fair share of challenges related to managing blockages in the screen mesh as well as requiring a large screening area. "Air classifiers are very efficient in fines classification and the

material cut points can be adjusted without interruptions to production."

Abelho, however, notes that the main limitation in all dry separation methods is that they are ineffective on material with a high moisture content. This applies to both screens and air classifiers.

Metso Air Classifier

An exciting product for fines removal is the Metso Air Classifier. It uses several air separation principles in a single machine. Air classifiers separate and recover ultrafine, fine and coarse materials in mining, aggregates production, sand manufacturing and other industrial processes.

"The Metso Air Classifier can be described as a gravitational inertial classifier which uses the principles of gravity, inertia, centrifugal and aerodynamic forces to efficiently separate fines. It makes use of two adjustable air streams to vary the cut point when separating fines. It has no moving parts in the material stream and has a minimal impact on the environment," explains Abelho.

Gravitational inertial air classifiers utilise secondary air flow, along with gravity and sharp directional change, to make adjustable, accurate separations of material from 300 microns to 63 microns. With no moving parts and extensive use of ceramics in wear areas, the gravitational inertial air classifiers require limited parts replacement and virtually no maintenance.

Metso's gravitational inertial air classifiers are widely used to produce manufactured sand and mineral fillers. "Gravitational inertial air classifiers separate fines from crushed rock in manufactured sand production. The dry solution uses a unique chamber and airflow design to ensure precise separation of ultrafines from sand with an accuracy of microns," says Abelho.

The solution uses a unique chamber and airflow design with ceramic liners to ensure precise separation of ultrafines from sand. The end result is sand with optimised shaping, gradation, and particle moisture. Highly durable ceramic tiles are used to protect the classifier's body. The tiles need to be replaced every four to seven years, which is double the two to three year replacement interval of hard-rock liners. Ceramic tiles are suitable for all types of feed material: abrasive, hard and soft rock.

Gravitational inertial air classifiers use a primary and a recirculating secondary airflow to separate fines from coarse particles. Because the airflows are not affected by wear, the grading remains consistent to an accuracy of microns. At the same time, particle moisture remains at an optimal level.

Thanks to the process not using water, it is both economical and environmentally friendly as well as ideal for colder climate. The volume of ultrafines in the end product is adjusted by changing the total airflow, and by changing the ratio of primary and secondary airflows.

How does it work? Feed material is evenly introduced from the top of the classifier in a controlled curtain along with primary air. Secondary air is drawn in at the bottom, inducing a scrubbing effect on similar-sized particles. "Recirculation and scrubbing enables high efficiency and precise separation of ultrafines. Coarse particles drop out of the bottom of the classifier through an airlock," concludes Abelho. ●

Leica Geosystems' WingtraOne deployed in a quarrying environment.

GEOSPATIAL DATA FROM THE SKY: THE USE OF DRONES IN QUARRY SURVEYS

In times of financial difficulty, quarries can turn to technology to improve productivity. Accurate geospatial data is crucial to the effective management of quarry operations and unmanned aerial surveys provide a more affordable, quick and safe solution. In this feature, we take a look at this technology and the advantages it brings to the quarrying industry. By Mark Botha.

At open-pit mines or quarries, a drone survey refers to the use of a drone or an unmanned aerial vehicle (UAV) equipped with a downward-facing RGB camera to capture images of a site from different vantage points, says Helgardt Junior van Heerden, UAV specialist at Leica Geosystems Southern Africa.

From these images, photogrammetry software can recreate geo-referenced 3D maps, contour lines, digital terrain models or digital surface models of the mining site.

Mining operators can also extract the precise volume of stockpiles or areas to be excavated and Van Heerden says some advanced mining software programs can also generate industry-specific data such as safety berm heights; crests and toes; road boundaries; widths; crests and slope, length and elevation change.

Henno Morkel, a UAV specialist at positioning solutions company Optron, says accurate geospatial data is crucial to managing quarry operations efficiently. He says the introduction of drones into quarry, mining and aggregate operations has set a new standard in safety while producing reliable, accurate geospatial data.

"By using fixed-wing or multi-rotor drones (depending on the size of the quarry), a single, automated flight mission will capture aerial data rapidly and produce georeferenced imagery of the

entire site."

He says that, with updated 3D imagery, surveyors can stockpile volume, optimise traffic management, monitor structural movement and plan future infrastructure development.

"Drone surveys create a safe work environment for surveyors, with little to no effect on production and/or the daily operation of the quarry, resulting in a quick return on the initial investment."

He says aerial surveys provide high accuracy, ease of use, improved productivity as fewer surveyors are needed, quick results, and the ability to reach inaccessible areas, among others. Using unmanned aerial vehicles also improves safety, as these vehicles are operated remotely, and versatility, as the data gained can be used in various applications.

Johan Janse van Rensburg, an aeronautical and mechanical engineer at Aquila Drones, says mining operations where UAVs are implemented in various applications soon realise the benefits and added value this technology brings to their operations.

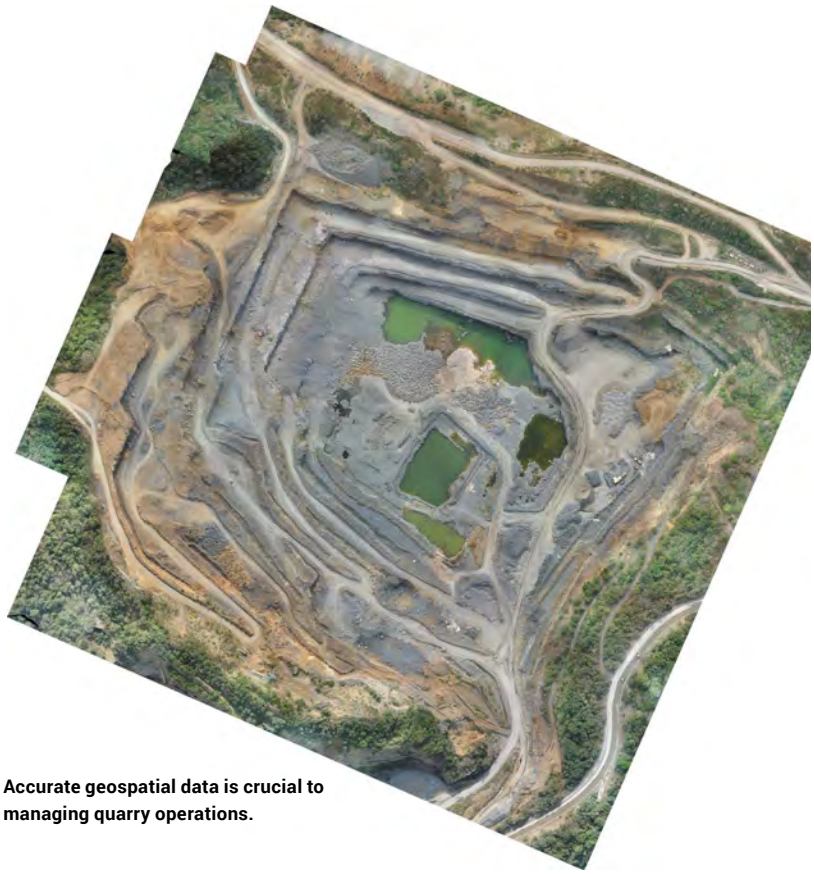
"Having access to accurate and detailed information of the mining site ultimately increases efficiency and allows for optimised management and planning, as well as subsequent coordination of resources."

He says using drones for site surveys enables quick turnaround times, from acquisition to having a digital dataset available.

"The unlimited aerial data that can be collected with drone technology means engineers can record and track more information in less time, allowing them to focus on analysis and interpretation."

Aquila Drones, in association with Darkwing Aerial Solutions, provides the complete survey dataset containing a high resolution ortho-mosaic image, 3D point cloud and a 3D mesh, made available online via an optional web-based cloud service.

"The 'read only' or 'full access' modes allow for quick availability and sharing of the information within the company. The client can also perform their own, custom 3D measurements of distances, areas and volumes on this dataset, while

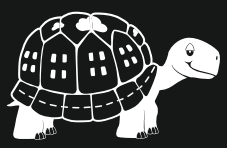


Accurate geospatial data is crucial to managing quarry operations.

KEY TAKEAWAYS

A drone survey refers to the use of a drone or an unmanned aerial vehicle (UAV) with a downward-facing RGB camera to capture images of a site

A single, automated flight mission will capture aerial data rapidly and produce georeferenced imagery of the entire site



South Africa's adoption of drone technology in the quarrying industry is slower than in the rest of the world

Benefits include improved plant and operational efficiency and safety; a reduction in survey costs; time savings and better productivity and profitability

The AQ2 Gimbal drone used by Aquila Drones.

An M300 RTK drone used by Optron.

adding comments on the dataset, which are visible to all role-players."

This feature serves as a critical management tool which ultimately provides productivity and efficiency in multiple sectors. Productivity further benefits from the fact that the operation is hardly affected while the survey is being performed.

"Drone data provides more precise volumetric measurements of stockpiles and mine pit measurements which, in turn, allow for improved production and stock monitoring."

With the accuracy of the photogrammetry survey process, it is no longer necessary to shape or dress stockpiles into uniform shapes, with flat tops, as is typically required for conventional stockpile surveying methods. He says this results in a direct cost saving and increased productivity.

"Another advantage of using drones with remote sensing capabilities is improved personnel safety and, ultimately, improved productivity. Heavy equipment operations can continue while it is no longer required for personnel to traverse steep and dangerous stockpiles or mine pit benches and steep slopes to perform measurements. This is all done from a safe height above-terrain, using drones."

Local uptake

Optron's Morkel says South Africa's adoption of drone technology in the quarrying industry is slower than in the rest of the world: "I believe this is due to the strict local legislation governing the use of commercial drones."

He says a number of key players in the quarrying industry world-wide are using drones to optimise their quarry operations.

"These large quarrying groups have successfully incorporated UAVs into their existing workflows. They are constantly finding new applications and added value offered by aerial data collection."

Janse van Rensburg agrees, saying the uptake of drone-based aerial surveys has generally been relatively slow over the past five years.

"Noteworthy in this regard is that most companies that did subscribe to the service and experienced the benefits and value continued to use this method of surveying. However, the pandemic did have an effect as many smaller operations had to scale down in numerous areas of business. However, we expect that more quarries will realise that the benefits associated with UAV surveys far outweigh the costs."

Key applications

When asked about the most important applications for UAV surveys in the quarrying industry, Morkel provides a list including cut & fill as well as stockpile volume; material classification (with GIS applications); deformation and movement monitoring; inventory and traffic management; security and infrastructure maintenance, and planning, among others.

"When focusing on drone applications at the typical quarry mining operation," says Janse van Rensburg, "there are a number of extremely useful UAV applications currently used by our clients."

He says one of the most common applications for drones at quarries is stockpile measurements. The challenges faced while managing stockpiles is the extreme height and area covered, which tend to change frequently.

"The use of drones to capture datasets with subsequent photogrammetry-based measurements yields highly accurate results. For many clients, this change has revealed errors in their processes originating from bulk density information, compacting, weight discrepancies and other process related issues. Stockpiles can be measured with confidence irrespective of the shape, size or slope they are placed on, as long as the surface is relatively flat."

However, he says most companies opt to have the total plant and pit area surveyed every month. When using primarily fixed-wing drones, this does not result in significantly higher costs.

"The typical footprint of most operations allows for the total plant and stockpile area and even the pit to be flown every month," says Janse van Rensburg. "This provides management with a monthly snapshot of the total plant. This dataset is then typically used for various management

activities, planning and measurements, and even serves as a record of the assets on site."

With the pit available in this online, accessible dataset, blast planning and slope analysis can be performed and haul roads can be planned and optimised. Elevation profiles can be generated by the client at any location.

"One very important survey is a high-detail annual aerial survey of the mine pit, generating a digital terrain model and a virtual geo-referenced point cloud at 1 cm accuracy. This point cloud is used by the mine surveyor performing the virtual survey using, for example, Model Maker to compile the annual mine plans in accordance with the relevant legislation."

On slope stability monitoring, he says the stability of open-cast mines is key to maintaining safety and efficiency.

"Examining the mechanisms of unstable slopes and monitoring them remotely are important for ensuring smooth mining operations. Studies have shown that UAVs can provide rapid identification and stability monitoring of slopes."

With highly detailed point clouds available, shift analyses where the change or material being moved over time can be evaluated and compared with production data.

Haul road network has a significant impact on the efficiency of mining activities and road conditions must be monitored constantly to ensure safe and uniform transit. Drones can facilitate this process by collecting large amounts of aerial data covering wider areas more precisely, which can then be used for planning, designing, construction and maintenance.

"We offer pit planning support where drill exploration data is used to compile virtual layers of differing rock materials. The final pit design is then compiled based on the EMP documents. These data sets are combined with the current state of the quarry pit to perform multiple optimisation studies related to pit planning."

Aquila Drones conducts vegetation health monitoring in the agriculture sector and has applied this technology in support of mining rehabilitation programmes.

"Being able to monitor both vegetation health and the Leaf Area Index (vegetation coverage) data over time, mining environmental and rehabilitation programmes become so much more efficient. These datasets are typically analysed and monitored in reference to original topography and vegetation baseline mapping, when available."

Benefits

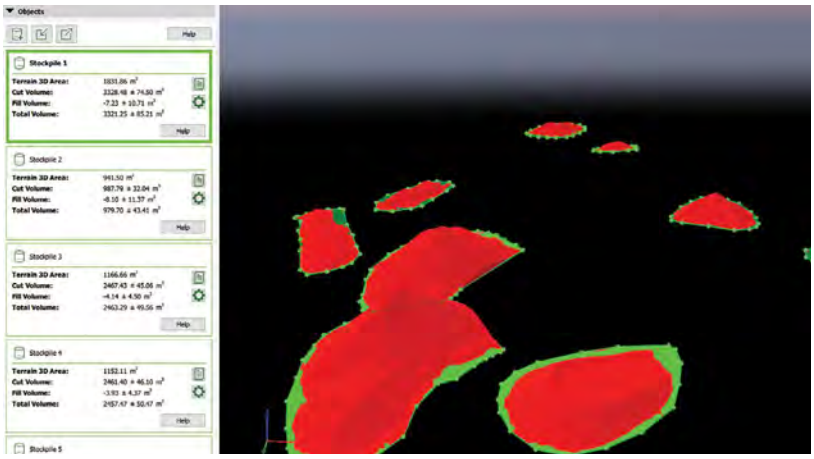
Optron's Morkel says some of the key benefits of using drones in the quarry industry stem from the remotely operated nature of the technology. These benefits include improved plant and operational efficiency and safety; a reduction in survey costs; time savings and better productivity and profitability.

"Compared to other monitoring methods," says Janse van Rensburg, "UAVs enable short revisit periods and fast data acquisition, as well as simple operations."

He says UAVs equipped with the appropriate sensors can acquire multi-source data for continuous monitoring, and that centimetre-scale images can be obtained rapidly, when the UAV is flown at low altitudes.

"As a dynamic, continuous and economical data acquisition method, UAVs now have a huge advantage in monitoring over traditional measurements or remote sensing technology.

"A significant advantage over conventional measuring methods is not having personnel traversing dangerous stockpiles and pit benches or coming in close proximity to operating equipment to perform measurements."



Stockpile measurements are among the most common applications for drones at quarries.

Because stockpiles are, by their nature, irregular in shape and exhibit craters, says Van Heerden, it is difficult to estimate their volume accurately by means of traditional methods such as GNSS (global navigation satellite system) surveying.

"Those slow and costly methods also prevent frequent surveys and can even threaten surveyors' safety, as they must climb up and down stockpiles and work among moving machinery."

He says drone aerial images can generate point clouds, digital surface models, digital terrain models and a 3D reconstruction of the mining site, including its stockpiles.

"Very accurate volume calculations can be performed with ease, as the point cloud contains several thousand data points. This enables accurate stockpile value calculations for monthly reconciliations or year-end audits, so improving the consistency of inventory reports on the company's balance sheet."

As UAV survey results and post-processing software are unbiased, the amount of material moved by subcontractors can also be validated, he says.

"Given the speed at which inventory surveys can now be conducted with drones, frequent data collection, done either weekly, monthly or quarterly, is proving to be cost-effective."

He says aerial surveys allow for better forecasting of the mineral stock available for sale.

"You can also fly your site as often as you like, without having to wait for a semi-annual aerial survey audit. Because you have the ability to run regular data collections, you improve inventory and operational management while eliminating the risk involved where surveyors work physically on the site face."

With an accurate site model provided by drone aerial images, mine managers can design and manage site operations more efficiently, while collaborating across teams. This, says Van Heerden, is because they can more accurately assess the volume of material to be extracted or moved according to plans or legal standards.

Aerial images also enable regular visual assessment of the state of haul roads, providing data such as length, slope and turning angles.

"With this information, you can optimise roads for your haul fleet by accounting for the specifications that cut fuel costs while ensuring that your mine is within planning and regulatory requirements."

He says drone data generally helps ensure that roads are built to design and that they meet current legal standards.

Drones in mining can help prevent disruption to operations due to unwanted or uncontrolled water or sediment flow. Flow and tailings pond operations can be modelled from the digital elevation maps produced by drone images.

"Because aerial surveys can be done frequently, you can create a visual record of the site over time, monitor progress on a weekly or monthly basis and store this for future operations or regulatory audits."

He says the use of drones allows for 3D reconstructions and surface models for drilling and blasting assessments.

"These models help to analyse the area to be drilled accurately and to calculate the volume to be extracted post-blasting. This data allows you to better manage resources such as the number of trucks needed. Volumes can be calculated more accurately by comparing surveys taken before and after the blasting, respectively. This, in turn, improves planning for future blasts and reduces the outlay on explosives, the time spent on site, and drilling."

Legislation and safety

The South African Civil Aviation Authority (SACAA) rules and regulations governing the use of drones in various fields of application are stipulated in the Remotely Piloted Aircraft Systems (RPAS) Regulations, says Optron's Morkel.

"These rules and regulations are specifically focused on ensuring the safety of both manned and unmanned aircraft, as well as on the safety of ground personnel."

In terms of these regulations, UAV operations are classified as either commercial; corporate; non-profit or private, and SACAA's regulations are applied accordingly.

The safety measures to be observed when conducting drone operations in South Africa are prescribed by several variables including the mass of the drone; its impact velocity should it fail and crash on site; flight altitude; flight and air traffic rules in terms of other aircraft; the proximity of the operation to airports and helipads, and visual line-of-sight.

Janse van Rensburg says the aerial survey service provider must hold a Remote Operator Certificate (ROC) issued by the aviation authority, and the personnel operating the UAV must be certified to do so. The drones used must also be registered with SACAA, based on an approved safety case and supporting documentation, which must be adhered to.

"In order to fly at a quarry, we would require airspace permissions to be in place, as well as permission from the site owner to fly our drones. With these two permissions, we would be able to operate legally. We would also conduct a pre-visit risk assessment, as well as an on-site risk assessment." ●

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Haul road maintenance practices play a huge role in the overall productivity and safe operation of quarries.

HAUL ROADS – THE HEART OF EVERY QUARRY OPERATION

Haul road maintenance requires a dedicated focus and should be addressed on a continual basis as part of the operational cycle since good roads improve production, extend tyre life and reduce overall operating costs, writes Munesu Shoko.

Haul road maintenance practices play a huge role in the overall productivity and safe operation of quarries. According to Nick Kyriacos, ADT product marketing manager at Bell Equipment, good haul road maintenance in a quarry operation is hugely important because a truck's suspension system can only do so much to deal with poorly maintained roads.

"We find that two things occur as a result of poorly maintained haul roads – firstly, the operator slows down because of the discomfort, which directly results in reduced productivity. We also find accelerated wear on components, which leads to unscheduled and unnecessary downtime, and productivity is again negatively affected," says Kyriacos.

While a strong relationship exists between haul road maintenance and economical, safe operations at quarry sites, the design aspect of haul roads cannot be underestimated. A good quarry haul road design, says Peter-Valentin Sauter, Caterpillar senior quarry specialist, means that trucks can travel in safe conditions at the most fuel-efficient level and rated speed with the target payload, day or night and in all weather conditions.

"Crowned straight sections, super-elevated curves and safety berms with drainage ditches on both sides

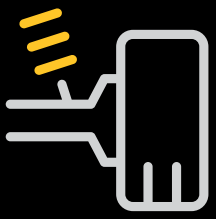
Caterpillar's quarry trucks aid quarry managers in their management of haul roads and in increasing truck life.

that are constructed with well graded sub-base material for lower rolling resistance are the hallmarks of a quality quarry haul road," says Sauter.

On most South African quarries, he says, two-way traffic must be accommodated. Three-truck width is preferred for travel on straight haul road sections, day or night. This rises to at least four-truck width when applied to corners and bends. Such distance allows safe and constant speed passing of loaded and unloaded trucks with optimum operator visibility, including the avoidance of blind spots in bends and at the top of the grade.

"A correct haul road width is vital. In reality, there will be areas where the ideal truck widths are not achievable. In these instances, truck speeds have to be slowed down and speed limit signs be introduced and thoroughly policed," explains Sauter, adding that safety berms measuring at least one half of the wheel height of the largest trucks in the fleet are usually a must for

KEY TAKEAWAYS



Good haul road maintenance in a quarry operation is hugely important because a truck's suspension system can only do so much to deal with poorly maintained roads

A good quarry haul road design means that trucks can travel in safe conditions at the most fuel-efficient level and rated speeds with the target payload, day or night and in all weather conditions

Good haul maintenance can reduce premature failures and vastly improve the tyre cost per hour, thus maximising the percentage of tyres removed fully worn

A badly maintained, bump and pothole heavy haul road can dramatically reduce component life, thus escalating repair bills

Haul roads clear of debris reduce premature failure of tyres.

Bell graders have a blade float function that allows the operator to position the blade to just grade the surface.

guarding haul roads.

To facilitate water-drainage, he adds, well designed haul roads are crowned in the straight sections. Around 2% is sufficient for most regions, although 3% might be required in higher rainfall areas.

Graeme Armstrong, sales representative at Komatsu South Africa, believes that the first step in enhancing productivity at a quarry site is the optimal initial design and construction of haul roads, as the maintenance that follows will just be maintaining a flawed design if the haul road was incorrectly designed and constructed in the first place.

"Ideally, keep gradients below 8%. This will reduce load transfer which can cause uneven loads on certain tyre positions, as well as reduce slippage (thus improving fuel consumption) and spin cuts (reduction of cut separations of tyres and premature failure)," he says.

Poor design of corners and cut backs, adds Armstrong, can lead to excessive braking and acceleration, forces which cause increased tyre wear and heat build-up. He advises that haul road design should allow for wide turn radius where possible and adequate camber if achievable. This can allow for a more even cornering speed and improved productivity and reduced fuel consumption.

Haul distances are also important, says Armstrong, adding that consideration must be given to the tyres which will be used and their tread compounds. Incorrect TKPH (tons kilometres per hour) can lead to heat separations and premature tyre failure.

Tyres to the fore

Unwelcome and potentially costly extreme tyre wear tread separation can be generated by the high lateral tyre forces trucks generate when negotiating bends in haul roads, says Caterpillar's Sauter. This can be partially countered by super-elevation: the difference in height between the inside and outside edges of the banks of a road's bed.

"Well-designed, super-elevated bends ensure the load is correctly positioned over the tyres and truck chassis, lowering side forces on the tyre casing and leading to less scuffing and wear, he says.

"Furthermore, super-elevation leads to more consistent and safer truck speeds. Consistent truck speed maintenance allows for optimum fuel efficiency, since less braking and re-acceleration is required. Super-elevation levels are based on the bend's radius and the speed at which it is negotiated," adds Sauter.

It's key to achieve the right grade for each haul road when hauling uphill, adds Sauter, as it impacts on where the load rests on the tyres and reduces rock spillage. The ideal

A motor grader driven by a trained operator is crucial for clearing and grading haul roads and most critical to keep the haul road's rolling resistance to a minimum.

ratio of 33% of the load must be in the front of the truck and 66% in the rear, and the perfect grade is 8 to 10%.

"Consistent grades are critical for cutting transmission up/downshifting, lowering fuel consumption and raising drivetrain component life. Because they are starting at the loading face and ending at the dumping point, the haul road's load and dump sites should be smooth, without any rocks and potholes. Appropriate design of the bench and dump sites can prevent spillages and wear and tear on the tyres, while minimising the risk of accidents," he adds.

The greatest risks to cut and damaged tyres, says Sauter, are rocks, debris and potholes in the haul road. Therefore, ensuring haul roads are rock- and debris free should be a priority on all quarry sites to optimise tyre life and safety. Meanwhile, airborne dust and debris can harm operator visibility and therefore site safety – for this reason the need for efficient dust control cannot be ignored.

Commenting on how haul road maintenance affects tyre life at quarries, Armstrong says improved haul maintenance can reduce premature failures and vastly improve the tyre cost per hour, improving the percentage of tyres removed fully worn.

He refers to a survey conducted at one mine, which found that 44% of tyres are removed because of cuts (premature failure); 29% are removed for impact fractures (premature failure); 7% through tyre wear (fully utilised); and 20% removed prematurely for other reasons.

Overwatering of roads washes out fines, he says, and can cause rutting of the surface and deterioration of the road base, creating an uneven surface. This can result in pot holes and hollows which fill with water and, in turn, increase the chances of tyre cuts as the water acts as a lubricant.

"Uneven surfaces increase wear on all parts of the machine assembly and suspension. Haul roads clear of debris reduce premature failure of tyres. Most cuts and impact fractures occur around loading and dumping areas, as well as in areas with steep gradients, sharp cutbacks and turns," says Armstrong.

"Utilising a combination of tracked (Komatsu D65EX-16 or D85EX-15R) and wheel dozers (Komatsu WD600-6), as well as motor graders (Komatsu GD675-5 or GD825-2A mining grader) to clear and maintain loading, dumping and haul surfaces will reduce the number of premature failures due to tyre cuts, impacts, cut and tread separations," he adds.

Armstrong agrees that failure to maintain drainage can lead to water pooling, damage to the road substructure and costly reconstruction. Un-watered haul roads, he adds, can result in dusty conditions. Besides the environmental impact (especially where a quarry is located close to urban areas), poor visibility adds to the safety risk. Furthermore, the dusty conditions can result in increased maintenance costs, with air filters / oils needing to be exchanged more frequently.

According to Kyriacos, the two aspects to haul road maintenance are to keep the road as smooth as possible and to remove material or rocks that fall from the haul trucks. This is because the rougher the road, the more flexion occurs in the tyres. This leads to increased heat built up in the tyres, resulting in a faster wear rate. At the same time, if trucks are driving and manoeuvring on smooth, well maintained roads the abrasion effect of the road is minimised and there is less wear from tyre scuffing.

"If rocks are not removed as part of road maintenance, it may lead to premature tyre failure like side wall cuts, and this can be extremely costly. For example, an operation may budget 6 000 hours from a tyre, which means they take the price of the tyre and capitalise it over the 6 000 hours to get to a running cost per hour. The operation thinks it will operate at, say, R10,50 per hour for those 6 000 hours but when they have a premature failure, the tyre is replaced, and they start from scratch again at 6 000 hours and have to outlay for another new tyre. It increases the cost of operation substantially," explains Kyriacos.

Operating costs

Good haul road maintenance practices reduce overall operating costs. Kyriacos alludes to accelerated wear and strain on the machine, which could lead to additional downtime and impact on productivity and operating costs.

"If you had a smooth haul road and you did a normal month's production of X tonnes, if it was a poor haul road and you did the same number of tonnes you would have a higher wear rate and, at some stage, you would need to pay to fix that higher wear rate. So, for the same tonnage you have higher wear, which adds to the cost per tonne," explains Kyriacos.

Tyre costs are a significant portion

Komatsu's GD675 mining grader is ideal for clearing and maintaining loading, dumping and haul surfaces.

of owning and operating costs, he adds. "It varies according to regions and applications, but the hourly cost of tyres typically exceeds 10% of the total cost per hour over 10 000 hours."

Although not a primary issue, adds Kyriacos, there is also potential for good haul road maintenance practices to influence fuel consumption. On a long, smooth road an operator is able to keep a consistent speed for more economical fuel burn whereas on a poorly maintained road an operator will need to continuously slow down and speed up, which definitely increases fuel burn.

The equipment factor

Commenting on what influences the choice of equipment in haul road maintenance, Kyriacos says the main considerations when choosing a grader for haul road maintenance are the width of the haul road and the size of the haulage machines that use the road. For example, a Bell 872G grader is a larger machine that is better suited to applications running larger trucks like the B60E, whereas a Bell 620G grader would be a better fit for quarries running B30Es.

"Bell graders have a blade float function that allows the operator to position the blade to just grade the surface. It automatically keeps contact with the road so no fine tuning is necessary, which speeds up the process and reduces opportunity for operator error," says Kyriacos.

Excellent haul road maintenance, says Sauter, can be achieved with appropriate equipment and well-trained personnel. "A motor grader driven by a trained operator is crucial for clearing and grading haul roads and most critical to keep the haul road's rolling resistance to a minimum. Deploying a water truck with trained personnel helps dust control, especially in very dry areas socommon in southern Africa," he says.

Long-term proper grades, rolling resistance and dust control are elements that impact fuel efficiency and safe quarry operation. "Operator skills and training are vital for safety and fuel efficiency, and important in all other elements of quarry operations. Motor grader operators should be well versed in how to thoroughly maintain haul roads, thus ensuring optimum and safe hauling conditions at any weather conditions," says Sauter, adding that truck operators need to understand how their driving technique impacts safety, fuel efficiency and tyre life.

Equipment running on haul roads also has its own impact. For example, Bell Equipment manufactures a purpose-built 4x4 range specifically for hard underfoot quarry applications. These trucks are proven to reduce the cost per tonne of an operation, while providing the same production capacity and low fuel burn as 6x6 trucks in the same class.

"Since the 4x4 trucks have no middle axle, tyre scuffing is significantly reduced, which results in less damage to the tyres and the road surface and extended tyre life. It also contributes to a smaller turning circle for increased manoeuvrability in narrow loading and tipping spaces," explains Kyriacos.

Caterpillar's quarry class off-highway trucks, says Sauter, boast the engineering design and upgraded features found on bigger mining class trucks. One example is the Cat Road Analysis Control (RAC) system available at the larger end of the quarry trucks, such as the Cat 777G.

"Caterpillar's quarry trucks aid quarry managers in their management of haul roads and in increasing truck life. With cutting-edge advancements in design and manufacture, the comfort now offered on board off-highway trucks means the operator may not gain sufficient road-feel to detect damaged road conditions that can impact cost, productivity and fuel efficiency, and reduce truck life as a result of damage to tyres, rims, frames and power train components," he says.

However, Cat Road Analysis Control (RAC), a haul road management tool, gives operators feedback on road conditions, quantifies the severity of the condition and allows quarry managers to make more informed haul road maintenance decisions aimed at cutting overall costs. The onboard information technology tool designed to measure and benchmark haul road quality, RAC is integrated with the Vital Information Management System (VIMS) of the truck, measuring component loading and impact shock, and sending that data to the operator and office in real time.

GPS equipped trucks can identify coordinates and broadcast them to the site management. RAC's data and reports allow quarry managers to locate, quantify, monitor and manage haul road deterioration to enhance truck longevity and, crucially, reduce cost per tonne of moved material.

"Summing up, a badly maintained, bump and pothole heavy haul road can dramatically reduce component life, thus escalating repair bills. A considerately designed and maintained haul road prevents accidents and lowers fuel consumption, increases tyre life and allows higher and constant production speed and, therefore, shorter cycle times," concludes Sauter. ●

Metso Outotec's Nordtrack range reaches sales milestone

The new mobile crushing and screening range from Metso Outotec, Nordtrack, has passed the milestone of 100 units sold worldwide. The sales of the range started during Q1 2020.

"This is a remarkable achievement for a new product range, especially considering how the pandemic has impacted the construction industry around the world," says Vesa Tuloisela, director, Nordtrack offering at Metso Outotec. "It strengthens our expectation that the potential Nordtrack customers appreciate the reliability and support of a premium brand. We believe that the demand for aggregate recycling equipment is on a steady path."

Sales and deliveries have started globally and the biggest demand so far is coming from North America and Europe. Customers have ordered Nordtrack crushers for C&D (concrete and demolition) waste sites and aggregate quarries, and Nordtrack screens for aggregate screening and industrial applications, such as mulch screening and top-soil pre-screening. Mobile conveyors are used as auxiliary equipment to complete the crushing and screening plants.

Sales of the range started during Q1 2020.

"It is a range which meets the needs of the small and medium sized contractors who are looking to expand their business in aggregates, whether it is recycling or small-scale virgin aggregate production," says Tuloisela. "The features and options of the range have been selected in a way that the equipment is easy to use and move between worksites. We have plans to announce new features and a range of extensions in the near future."

"I want to express my warmest gratitude to all our customers and distributors who have welcomed Nordtrack. We continue to develop both the Nordtrack range and our Lokotrack mobile equipment portfolio to reach a more diverse customer base," he concludes.

Produce up to 15 000 tph with the Niagara XL-Class vibrating screen

Haver & Boecker Niagara offers the Niagara XL-Class vibrating screen, which combines advanced exciter drive technology with a wide body to offer producers high-capacity screening action at up to 15 000 tonnes per hour.

The XL-Class is the largest exciter-driven machine in the industry. It is ideal for high tonnage rates, such as iron ore and oil sands applications. Each XL-Class machine is custom-designed to its specific application using Finite Element Analysis (FEA) to predict the structural behaviour of a vibrating screen.

With more than 15 years of FEA and experimental measurement experience – and nearly 400 high-capacity vibrating screens supplied to the global market – Haver & Boecker Niagara is able to provide state-of-the-art high-capacity vibrating screens that offer easy operation, low maintenance and unmatched reliability.

"Haver & Boecker Niagara is dedicated to using innovative technological solutions to enhance customers' daily processes," says Eduardo Iizuka, Haver & Boecker Niagara chief engineer of product development. "Our ability to optimize the XL-Class to perform at peak efficiency, according to exact application requirements, provides a reliable, low-maintenance screening solution for our customers."

Haver & Boecker Niagara strategically engineers the XL-Class vibrating screen using FEA, which predicts high stress areas and natural frequencies. FEA is a numerical simulation tool used by Haver & Boecker Niagara engineers to assess the structural behaviour of a vibrating screen.

The analysis equips engineers with the appropriate information to understand the machine's expected performance, determine where to reinforce critical areas of the vibrating screen and reduce the weight of oversized components, resulting in an optimized vibrating screen. Haver & Boecker Niagara then customizes each XL-Class to perform at maximum productivity according to a producer's specific application requirements.

The vibrating screen features a robust, maintenance-friendly design. The fully-bolted, nonwelded construction of XL-Class side plates eliminates the possibility of stress concentrations from welding. The machine's large deck size maximizes feed rates, enabling the machine to effectively handle production rates as high as 15 000 tonnes per hour and cut sizes from 48 mesh to 10 inches. The overhead, bridge-mounted drive system does not interfere with the material flow path, reducing the wear potential that shaft-driven machines experience.

Each XL-Class machine is custom-designed to its specific application.

Two SANY SY335C excavators for Wearne Quarries

Wearne Quarries has taken delivery of two SANY excavators from Goscor Earthmoving Equipment.

Two SANY SY335C medium excavators from Goscor Earthmoving Equipment (GEM) have been delivered to Wearne Quarries of KwaZulu-Natal. The aggregate producer mainly supplies crushed stone for cement manufacture and will use the excavators for hard-rock excavation and loading articulated dump trucks (ADTs).

"The reason for selecting the SANY SY335C for this arduous application is not only that it is a particularly tough and robust excavator, but our analysis revealed it is the best option to meet the required production output and also deliver the lowest cost per ton," explains operations manager Murray Leith.

No modifications were required on these excavators, which are equipped with rock buckets. "We now offer a fully automatic greasing system as standard to assist with maintenance and thereby extend the lifetime of the machines," adds Leith.

The machines were also sold with a 36-month/8 000 hour warranty, which is an extension of the standard 18-month/3000 hour warranty. Included is a full service plan that will see the machines serviced at regular 250 hour intervals. In addition, Goscor Finance assisted Wearne Quarries in acquiring the equipment, thereby supplying the customer with a complete solution.

The brand-new excavators were sourced directly from the factory in China. Upon arriving at Durban harbour, they were immediately transported to Wearne Quarries, arriving on-site in late September. The Durban branch of GEM assisted with the handover, and providing toolboxes and operator training as well.

"We have established a good business relationship with the client over the past year and a half due to our commitment and aftermarket support," notes Leith. A prominent aggregate producer in the region, Leith is confident of repeat business from Wearne Quarries in the future.

The SANY SY335C medium excavator features an auto deceleration system that reduces fuel consumption by 5% to 10%. When an operation stops for 3,5 seconds, the engine speed drops automatically to idle level, and maintains this idling state.

The strengthened structure makes it an efficient and robust machine for a range of applications. The dual-pump, dual-circuit constant power control system means that the Isuzu engine outputs a continuously strong operating force.

Booyco sets benchmark in collision avoidance with CXS

Supporting mines in their quest for zero-harm, Booyco Electronics' CXS solution has leveraged technology to achieve new levels of safety in underground and surface mining environments. The Booyco CXS is a best-of-breed system providing a comprehensive and integrated response to Level 7, Level 8 and Level 9 requirements.

"The Booyco CXS solution is engineered to mitigate the risk of collisions between pedestrians and vehicles, or between vehicles, in operational environments," says Booyco Electronics CEO Anton Lourens. "This system takes the vital step from being just a warning system to becoming a collision avoidance system."

Lourens highlights that the Booyco CXS is a best-of-breed system that consolidates everything the company has learnt in its 15 years of serving the sector. By upgrading to a new hardware platform, the system's software updates can be conducted remotely and more frequently – providing increased functionality. It also allows users to comply with the latest and ever more stringent safety regulations.

"Our Booyco CXS is a comprehensive and integrated response to Level 7, Level 8 and Level 9 safety levels – as defined by the Earth Moving Equipment Safety Round Table (EMESRT)," he says.

The new hardware platform is based on principles proven by Booyco Electronics over many years. Technology includes the reliable and accurate Very Low Frequency (VLF) technology for pedestrian detection, and GPS and radio frequency technology for vehicle detection in surface applications.

"At the heart of the system is the Booyco Host Unit (BHU)," Lourens says. "This receives information from the pedestrian sensors, the trackless mining machine (TMM) sensors and the wheeled mobile equipment sensors. It then conducts the necessary proximity calculations and algorithms to alert users to any impending risk scenarios."

Lourens also emphasises that this BHU integrates seamlessly with original equipment manufacturer (OEM) systems, either directly or through a third-party interface in accordance with ISO 21815.

"This allows the Booyco CXS to apply Level 9 intervention instructions to the machine, as required to for example automatically slowing it down or bringing it to a complete stop," he says. "Our flexible, comprehensive approach with the Booyco CXS solution has been developed to ensure that all customers can achieve Level 9 compliance, irrespective of the age of their machines."

Caterpillar launches new D9 GC dozer

Application-specific configurations and multiple blade attachments deliver efficient dozing performance in a range of applications such as mining and quarrying.

New from Caterpillar is the Cat D9 GC dozer, said to be built for best-in-class owning and operating costs while delivering reliable performance and straightforward operation and maintenance. Sharing the same frame as the Cat D9 dozer, the new Cat D9 GC continues the series legacy with its superior durability. The frame, powertrain and major components are designed to be rebuilt to give the dozer a cost-effective second life with like-new performance.

Application-specific configurations and multiple blade attachments deliver efficient dozing performance in a range of mining, construction and industrial applications such as production dozing, ripping overburden, site maintenance, fleet support, bulk materials handling and land reclamation. Special configurations are available for desert, arctic and steel mill applications.

The D9 GC replaces the D9R and continues to feature the proven Cat 3408C engine, producing 308 kW in the new dozer. The engine now offers longer fuel and air cleaner life, a single high-efficiency oil filter for lower maintenance costs, and a new, robust self-tensioner. The D9 GC powertrain incorporates the Cat three-speed planetary powershift transmission and torque divider with free-wheel stator, which puts more power to the ground and saves fuel.

Delivering more tractive effort to push through tough cuts, Caterpillar's elevated sprocket and suspended undercarriage isolates the final drives, axles and steering components from harsh impacts to increase machine longevity. The suspended undercarriage reduces shock loads transferred to the undercarriage by up to 50%, resulting in a smoother, more comfortable ride for the operator.

The D9 GC offers an isolation-mounted operator platform with ROPS and FOPS for operator safety and comfort. The Cat Comfort Series seat is fully adjustable with thick seat and back cushions to improve operator comfort and support. Simple hand controls combine steering clutch disengagement and brake application for each track to deliver straightforward operation. A notched fuel tank and narrow ripper carriage deliver exceptional visibility of the front and rear work areas to enhance operating safety.

The new D9 GC has many of the same components, parts and systems of the D9R dozer, offering a familiar design for service technicians. Both left and right equalizer bar pin bearings and pins are conveniently lubricated from a remote lubrication point that is easy to access. Daily powertrain oil check and sampling ports are conveniently accessed from the service platform for added safety.

The Booyco CXS has leveraged technology to achieve new levels in safety.

ACHIEVING QUALITY IN CONCRETE MAKING

Over the past few months, the quality of concrete in construction has been a burning issue and ASPASA members have subsequently raised their concerns with the association. The ASPASA Technical Committee has been in contact with members and several problems have been identified. Out of this exercise, it has been identified that serious training is required, and a service provider is already developing the relevant courses.

Nico Pienaar, director of Aspasa.

Concrete is the most important single material for building and civil engineering. The word 'concrete' is often used to refer to something which is solid, reliable, immovable, durable and maintenance-free and has an almost infinite 'service-life'. However, several recent well publicised structural failures throughout the world have caused not only the public, but also the cement and concrete industries itself, to question this definition.

Problems which are tarnishing the image of concrete include:

- Corrosion of reinforcing steel either due to the inclusion of calcium chloride or other salts from admixtures or aggregates, or externally from marine structures above the high-tide zone
- Poor, hurried construction techniques where ground salts contaminate aggregates and water
- Internal disruption of concrete from alkali-silica reaction and strength reductions due to the conversion of high-alumina cement concrete
- The occurrence of non-structural cracks during setting and hardening due to moisture and thermal effects

Production and use changes

It is true that good-quality reinforce concrete is made from cement, sand, aggregates, water and steel reinforcement — and so is bad-quality concrete. So, what is happening? It is important to understand the considerable changes which have occurred in concrete materials, manufacture and use.

Design and construction: Codified and computerised design methods are separating the design engineer even further from the practical realities of concrete construction. The contractor has difficulty in finding staff with the necessary skill and experience, willing to carry out concreting operations on site. It is still easier to test materials and products than it is to assess construction practices.

Production methods: Some 40 years ago, the contractor carried out all concrete manufacturing and construction on the job site. Engineers now have a situation where most concrete is made off-site with precast and of site placed concrete being supplied as ready-mixed.

Standards and specifications: For many years concrete quality was prescribed in terms of mix proportions by volume in the mistaken belief that cement was a uniform product and therefore quality was proportional to the amount of cement. Since water/cement ratio was known to be important, the usual practice was to use as little water as possible with intense vibration.

As engineers appreciated the need to know the strength of concrete, the 28-day cube test and designed mixes became more common. Variations in materials, as well as manufacture, resulted in variations in concrete strength, which the engineer put down to poor production standards. And so, they have drafted more restrictive standards in which the limits on strength, cement content and water/cement ratio are rarely compatible for any given source of material.

Most of the basic problems, however, are associated with the higher strengths of cement which enable higher water/cement ratios to be used than 40 years ago, resulting in more permeable mixes at the same strength level.

Prescribed mix specifications demand well graded, high quality aggregates because they rely on control of workability to control water/cement ratio. Strength specifications permit a much wider range of aggregates of perfectly adequate quality to be used.

Concrete usage: In the 1950's concrete mixes had very low work abilities, were handled using skips and dumpers and heavily compacted with immersion and shutter vibrators. The introduction of the small-bore mobile pump demanded more workable and cohesive mixes and has led to higher rates of placing.

Standards of workmanship have diminished over the years, with growing demands for higher productivity from less skilled labour. Many problems in finished concrete can be traced to inaccurate placing of steel with insufficient cover, poor compaction of concrete, the unauthorised addition of extra water and inadequate water curing.

Quality control and expertise: The trend from site-mixed, site-placed, concrete to ready-mixed and precast concrete has led to considerable improvements in quality. Site-produced concrete will vary from job to job. With factory-produced concrete considerable benefits of uniformity and economy can be achieved through the use of local materials in large quantities, special purpose production equipment and experienced labour.

These techniques and skills are often backed up by strictly enforced Certification Schemes, particularly for ready-mixed concrete and some structural precast elements.

Achieving quality in manufactured concrete

The concrete producer has a vital role to play in meeting the changes which have occurred and overcoming the various problems which exist to help restore the image of concrete. To satisfy the often conflicting demands of concrete standards and the contractor's requirements, however, the concrete producer needs information from the material suppliers on the characteristics of their product so that a full account of the effect of the material concrete can be established. ●

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